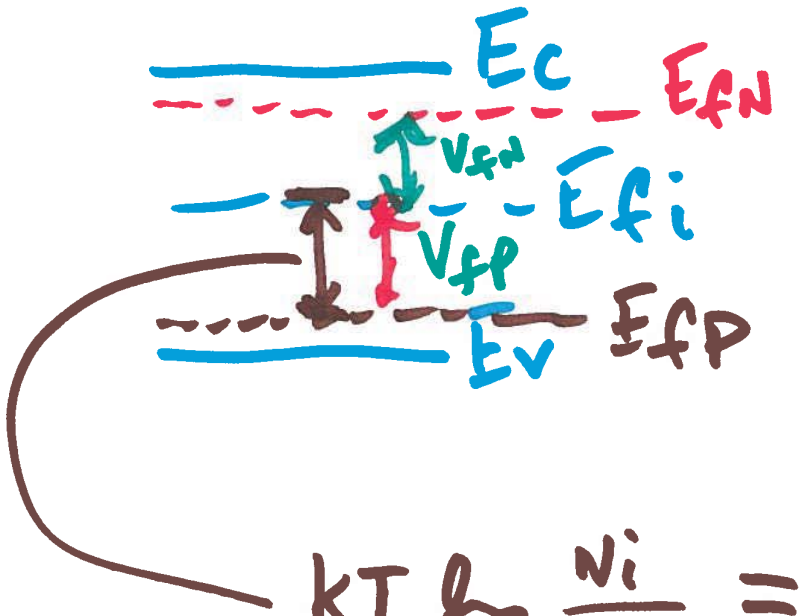
EE 421/ECG 621
Digital IC Design
OCT. 15, 2016
Study session I

$$t_d \cong 0.7 \cdot \frac{\ell(\ell+1)}{2} RC$$

ℓ is big

$$t_d \cong \frac{0.7}{2} \ell^2 \cdot RC$$

$$= 0.35 \ell^2 RC$$



dope silicon

donors → N_D

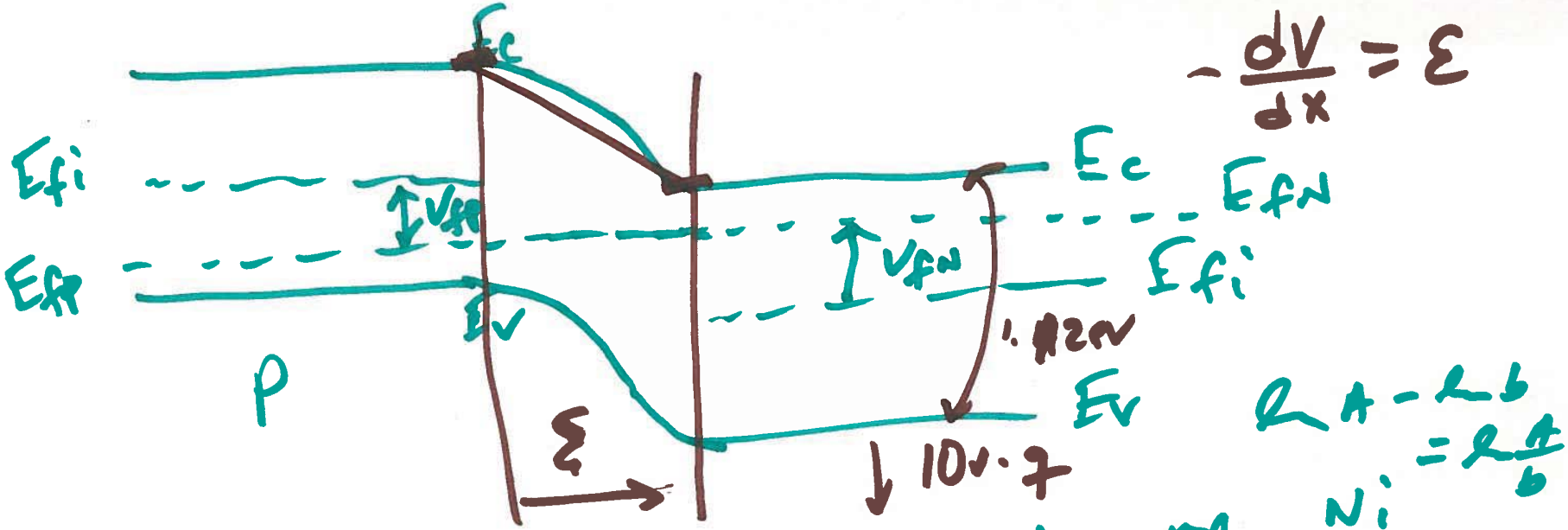
Acceptors → N_A

N_i = intrinsic carrier concentration

$$kT \ln \frac{N_i}{N_A} = E_{fp} - E_{fi}$$

$$|V_{fp}| = \frac{kT}{q} \ln \frac{N_i}{N_A} = \frac{E_{fp} - E_{fi}}{q}$$

$$V_{fp} = -\frac{kT}{q} \ln \frac{N_A}{N_i}, \quad V_{fN} = \frac{kT}{q} \ln \frac{N_D}{N_i} = \frac{E_{fN} - E_{fi}}{q}$$

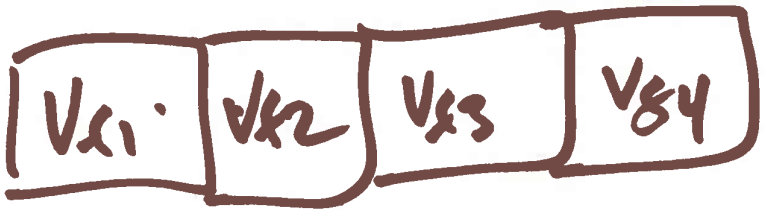


$$-\frac{dV}{dx} = \mathcal{E}$$

$$\ln A - \ln b = \ln \frac{A}{b}$$

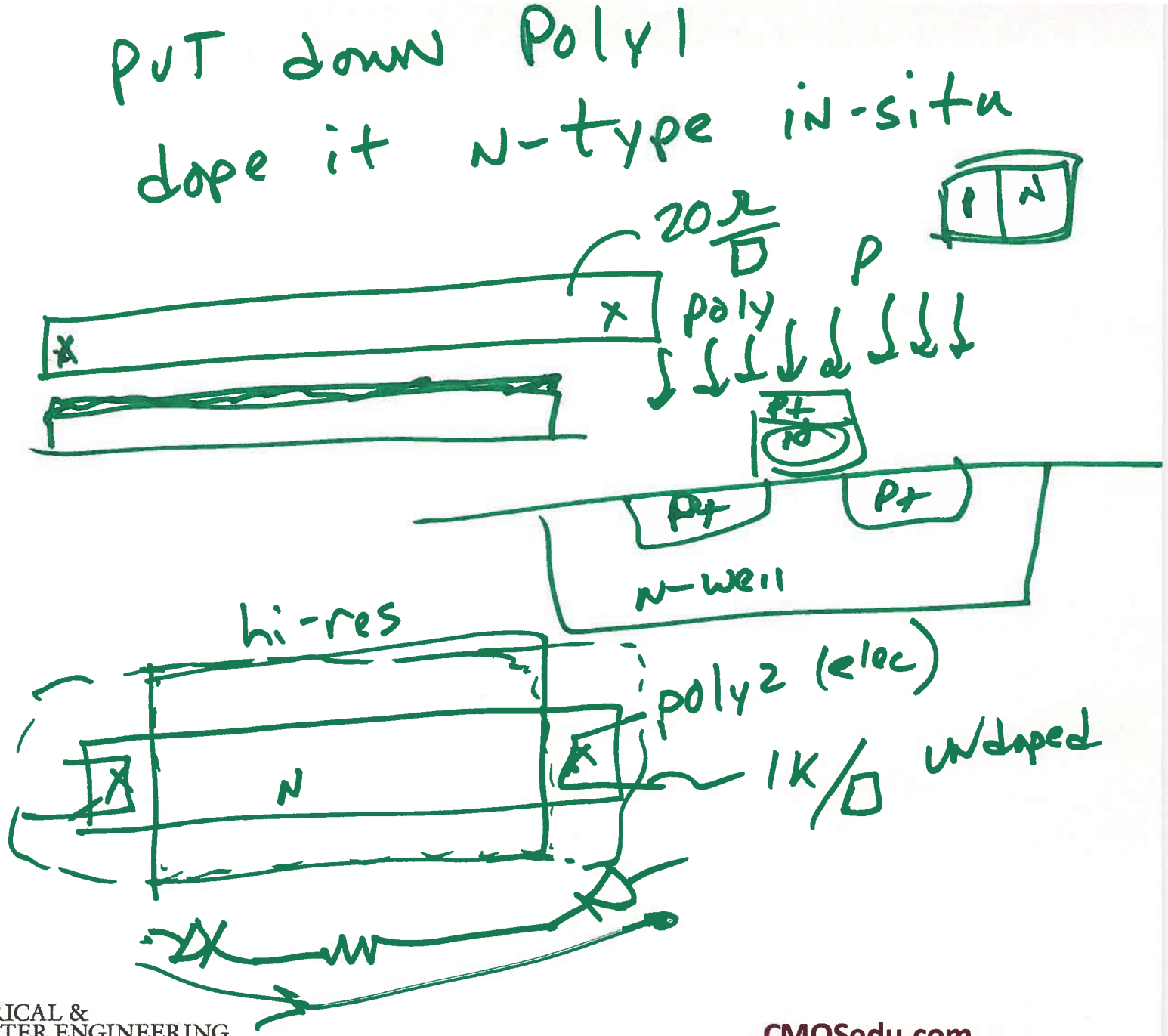
$$V_{fN} - V_{fP} = \frac{kT}{q}\ln\frac{N_D}{n_i} - \frac{kT}{q}\ln\frac{n_i}{N_A}$$

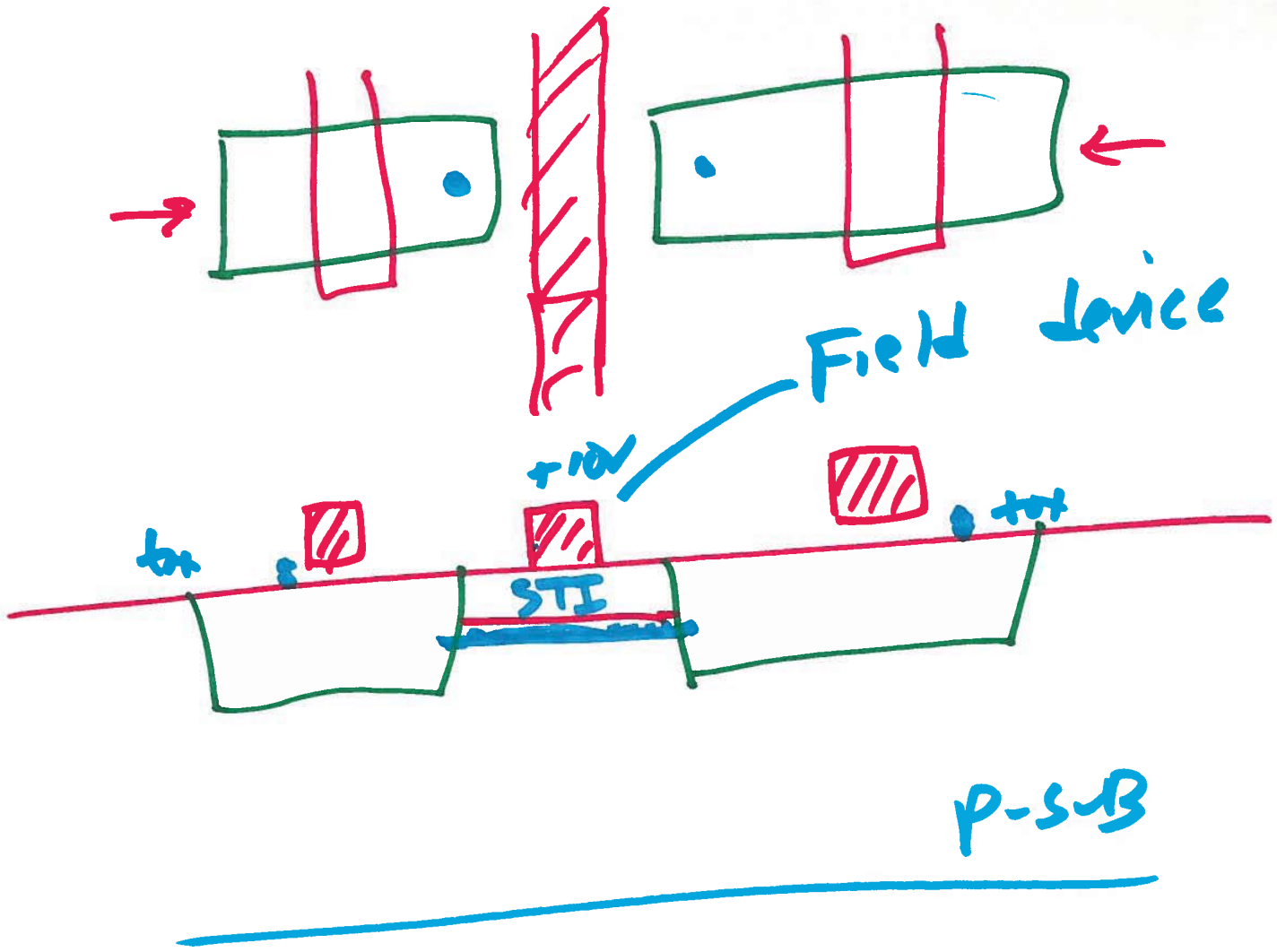
$$V_{bi} = \frac{kT}{q}\ln\frac{N_D N_A}{n_i^2}$$

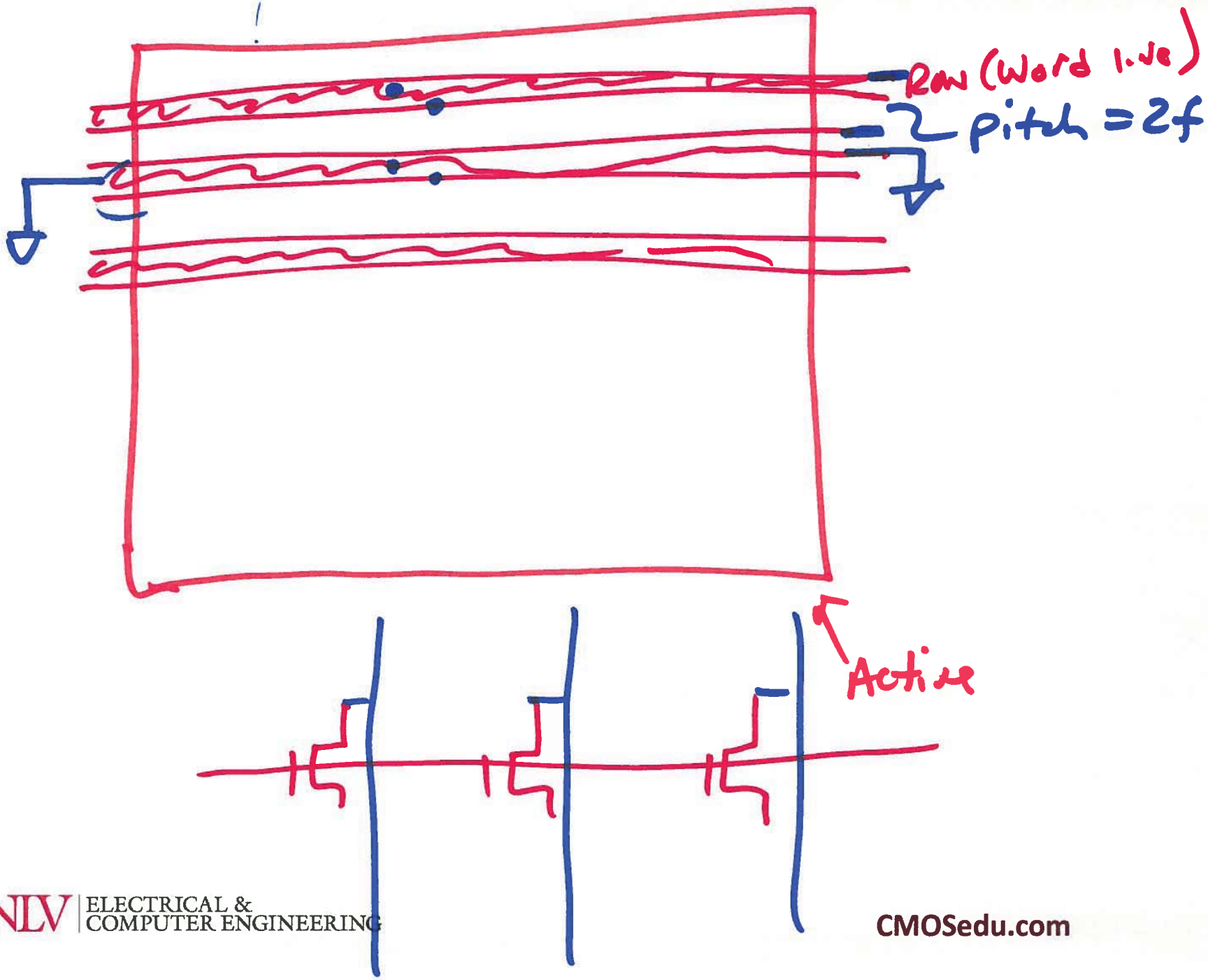


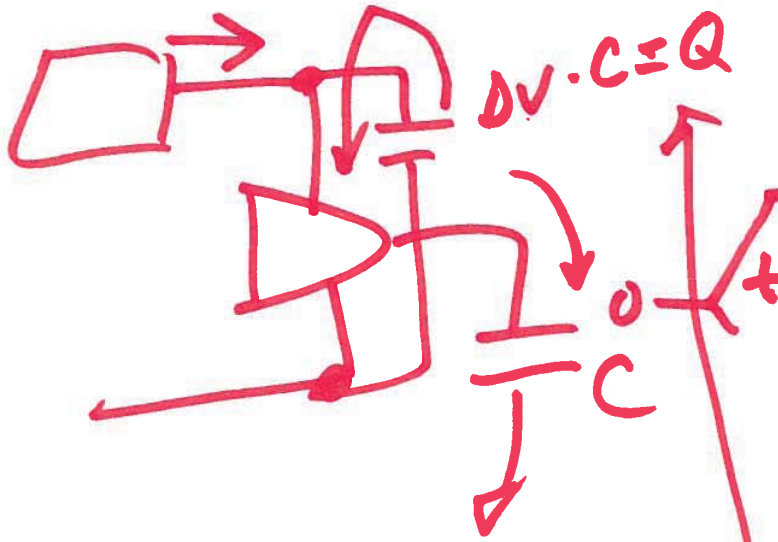
$$V_{f1} - V_{f2} + V_{f2} - V_{f3} + V_{f3} - V_{f4}$$

$$= V_{f1} - V_{f4}$$


PUT down Poly1
dope it N-type in-situ
20Ω/□
P
poly
X
X
P+
P+
P+
N-well
hi-res
poly2 (eloc)
1K/□
undoped
X
X
N


Field device
+10V
STI
p-sub


Row (Word line)
2 pitch = 2f
Active



$$I = C \cdot \frac{VDD}{tr}$$

$$= 100 \cdot \frac{5V}{1ns}$$

$$= 50mA$$

$$Q = \frac{50mA}{(1ns)^{-1}} = 50pC$$

$$\frac{Q}{T} = I \qquad Q = I \cdot T$$

$$= \int_0^T i(t) \cdot dT \qquad \text{const } T$$

8)